**WEATHER ANALYSIS LAB**

LAB REPORT – 83 pts.

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Group #: \_\_\_\_\_\_\_\_

Period: \_\_\_\_\_\_\_\_

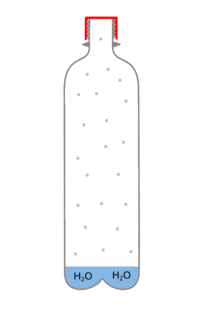
**OBJECTIVE:** To recognize various aspects of meteorology through experimentation and map reading.

**QUESTION:** How can you create a cloud inside of an empty water bottle?

**HYPOTHESIS:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **(1 pt.)**

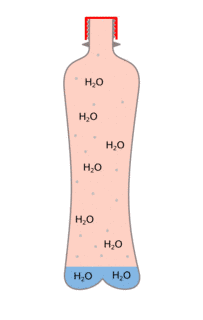
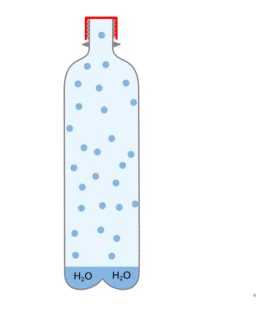
**MATERIALS:**

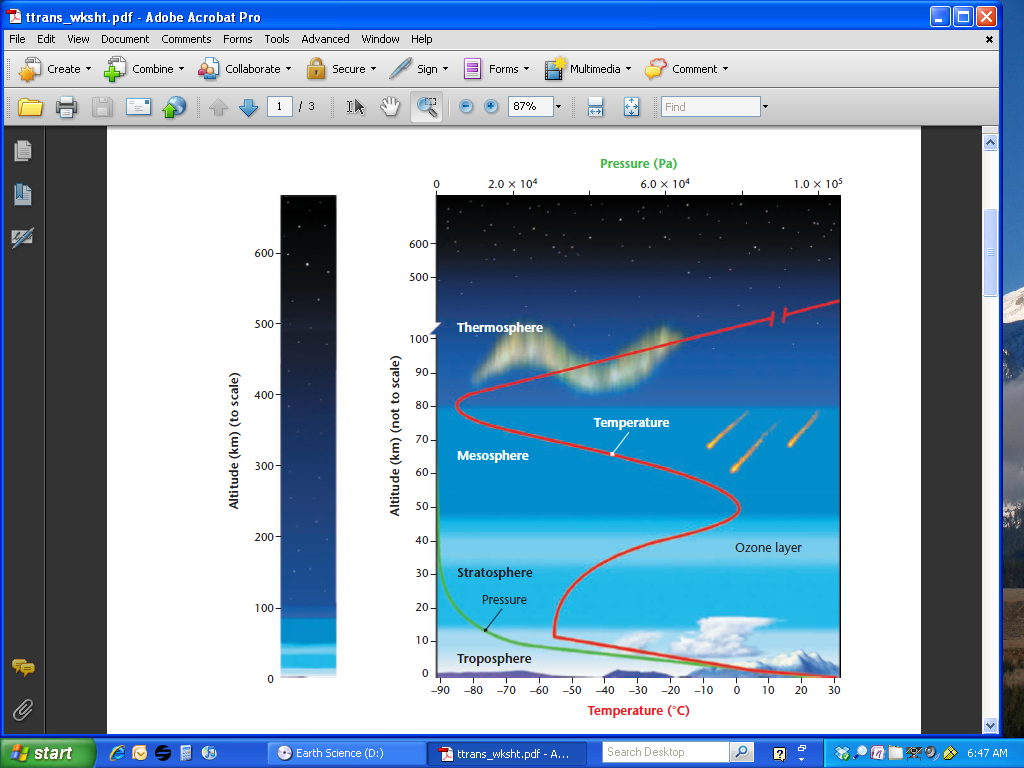
* Empty water bottle
* Match
* Colored pencils
* 1 lab report sheet per student

**INTRODUCTION:**

Air moves from areas of high pressure to areas of low pressure. In a high pressure system, there is **convergence** aloft and **divergence** at the surface where in a low pressure system we have the exact opposite with **convergence** at the surface and **divergence** aloft. In order to accurately forecast the weather, meteorologists measure various atmospheric conditions including air pressure, humidity, precipitation, temperature, wind speed, and wind direction.

**PROCEDURE:**

1. Begin by placing a small amount of warm tap water in the bottom of your water bottle. Cap the bottle, then shake the water around in order to coat the inside of it.
2. Create high pressure inside of your bottle by squeezing it. As you are doing this, you are compressing the air and creating an increase in temperature because the water vapor molecules are moving faster. Some of the warm tap water is also evaporating at this point.
3. Now, create low pressure in your bottle by releasing your squeeze. By releasing your squeeze, you are allowing the air to expand and cool. Clouds normally form in areas of low pressure when warm air rises, cools, and condenses. You probably didn’t see a cloud form though.
   1. Why didn’t you see cloud formation inside of your water bottle when you released your squeeze and created low pressure, allowing the air to expand and cool? **(1 pt.)** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Uncap the bottle and carefully light a match. Allow it to burn for a few seconds, blow it out, and place the extinguished match inside of your water bottle.
5. Create high pressure inside of your bottle once again by squeezing it. Then create low pressure by releasing your squeeze. The water should have been able to cool and condense on the smoke particles (condensation nuclei) inside of your bottle.
   1. Were you able to see cloud formation this time when you created low pressure? **(1 pt.)** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. Uncap the bottle and dump the water down the sink drain at your lab station and properly dispose of the extinguished matches in a nearby garbage can.
7. Squeeze the bottle, releasing any smoke particles, and rinse it out. Place the uncapped bottle back in your lab basket in order for the next group to have a fresh start with it.
8. Examine the diagram below based on the layers of the atmosphere. Label all layers and any other important information in the blank spaces using your notes from this section. **(8 pts.)**



* 1. Does temperature increase or decrease with altitude in the: **(1 pt. each)**

Troposphere: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Mesosphere: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Stratosphere: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Thermosphere: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Using the table provided below concerning average temperature readings at various altitudes, answer the questions on the next page: **(7 pts.)**
   1. What is the basis for dividing the atmosphere into the different layers? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. What is the approximate height range and temperature range of the:

Troposphere: Height 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_ Temperature 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

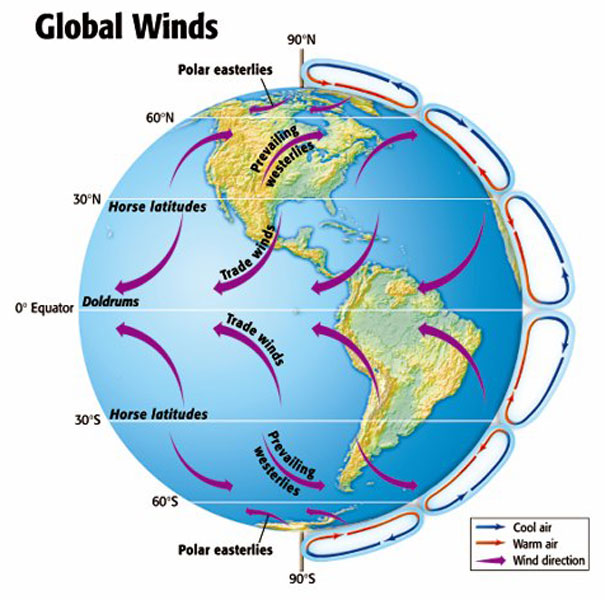
Stratosphere: Height 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_ Temperature 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Mesosphere: Height 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_ Temperature 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

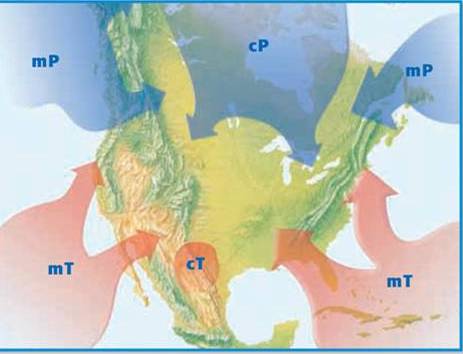
Thermosphere: Height 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_ Temperature 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. What causes temperature to increase in the stratosphere and decrease in the mesosphere? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  2. What causes temperature to decrease with altitude in the troposphere? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Label the global winds in the diagram below filling in the appropriate blank spaces. **(9 pts.)**



1. Label the air masses in the diagram below filling in the appropriate blank spaces. **(6 pts.)**



When viewing station models, it is necessary to decode the barometric pressure readings. Pressure normally falls in the range of 950 mb. and 1060 mb. Below are general rules to following when both decoding and coding barometric pressure readings.

WHEN DECODING BAROMETRIC PRESSURE:

* Add a 9 or 10 to the front of the coded 3 digit number:

If the coded 3 digit number is between 000 and 500 🡪 **ADD A 10**

If the coded 3 digit number is between 501 and 999 🡪 **ADD A 9**

* Add a decimal point between the last 2 digits.

For example:

Coded figure: 489 🡪 Full figure: 1048.9 mb.

Coded figure: 563 🡪 Full figure: 956.3 mb.

WHEN CODING BAROMETRIC PRESSURE:

* Drop the 9 or 10 at the beginning of the full figure.
* Drop the decimal point between the last 2 digits.

For example:

Full figure: 1027.3 mb. 🡪 Coded figure: 273

Full figure: 986.2 mb. 🡪 Coded figure: 862

1. Decode the following pressure readings: **(½ pt. each)**

389 \_\_\_\_\_\_\_\_\_\_

672 \_\_\_\_\_\_\_\_\_\_

502 \_\_\_\_\_\_\_\_\_\_

433 \_\_\_\_\_\_\_\_\_\_

972 \_\_\_\_\_\_\_\_\_\_

Code the following pressure readings: **(½ pt. each)**

1046.2 mb. \_\_\_\_\_\_\_\_\_\_

967.8 mb. \_\_\_\_\_\_\_\_\_\_

998.4 mb. \_\_\_\_\_\_\_\_\_\_

1012.5 mb. \_\_\_\_\_\_\_\_\_\_

1. Now look at the various station models and record the required data: **(½ pt. each)**

Barometric Pressure: \_\_\_\_\_\_\_\_\_\_

Temperature: \_\_\_\_\_\_\_\_\_\_

Dew-Point Temperature: \_\_\_\_\_\_\_\_\_\_

Barometric Pressure: \_\_\_\_\_\_\_\_\_\_

Temperature: \_\_\_\_\_\_\_\_\_\_

Dew-Point Temperature: \_\_\_\_\_\_\_\_\_\_

Cloud Coverage: \_\_\_\_\_\_\_\_\_\_

Current Weather: \_\_\_\_\_\_\_\_\_\_

Barometric Pressure: \_\_\_\_\_\_\_\_\_\_

Temperature: \_\_\_\_\_\_\_\_\_\_

Dew-Point Temperature: \_\_\_\_\_\_\_\_\_\_

Cloud Coverage: \_\_\_\_\_\_\_\_\_\_

Wind Speed: \_\_\_\_\_\_\_\_\_\_

Wind Direction: \_\_\_\_\_\_\_\_\_\_

Pressure Change: \_\_\_\_\_\_\_\_\_\_

Pressure Tendency: \_\_\_\_\_\_\_\_\_\_

Barometric Pressure: \_\_\_\_\_\_\_\_\_\_

Temperature: \_\_\_\_\_\_\_\_\_\_

Dew-Point Temperature: \_\_\_\_\_\_\_\_\_\_

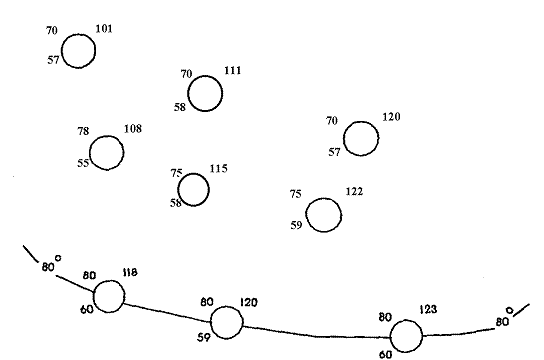
Cloud Coverage: \_\_\_\_\_\_\_\_\_\_

Current Weather: \_\_\_\_\_\_\_\_\_\_ Wind Speed: \_\_\_\_\_\_\_\_\_\_

Wind Direction: \_\_\_\_\_\_\_\_\_\_

Pressure Change: \_\_\_\_\_\_\_\_\_\_

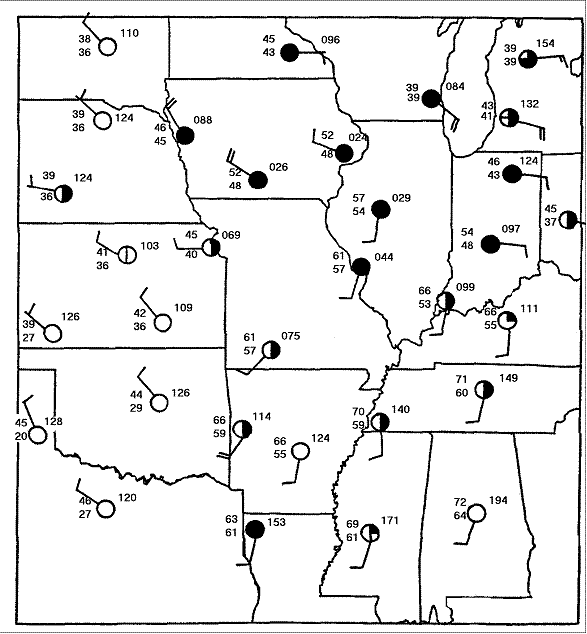
Pressure Tendency: \_\_\_\_\_\_\_\_\_\_



Weather maps become most useful when their information is analyzed in some fashion.  One means of analysis is to highlight the patterns of specific variables.  This can be done by joining lines of equal value.  In the figure to the right, an **isotherm** (line of constant temperature) is constructed through 80°F.

1. On the map below, draw and label isotherms using a red colored pencil at 45°F, 55°F, and 65°F. Then, draw and label isobars at 1004 mb., 1008 mb., and 1012 mb. using a green colored pencil. Also, label the low pressure system using a red colored pencil by placing an “L” at its location. Locate both the cold front and warm front associated with the low pressure system and label them appropriately. **(9 pts.)**

* Hint for front locations: sharp changes in temperature, moisture, and wind direction.



1. Answer all remaining lab questions and write your conclusion.
2. Make sure your lab station is cleaned up and all materials are placed back inside the lab basket at your designated station.

**LAB QUESTIONS (1 pt. each) –** *Please write your answers in* ***COMPLETE SENTENCES****!*

1. Explain the breakdown of Earth’s atmospheric gases.

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1. What is standard sea-level pressure in millibars?

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1. What is ozone and how is it important to life on Earth?

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1. What is the ionosphere and what happens in this section of Earth’s atmosphere?

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1. Suppose 1 parcel of air at 1 kg. can hold up to 27.5 g. of water vapor until it becomes saturated. The actual humidity has been calculated at 16.2 g. of water vapor. What is the relative humidity? Show your work and place a box around your final answer.
2. What are the two factors that affect relative humidity?

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1. Explain a psychrometer.

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1. Differentiate between the three types of clouds.

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1. What are the five major forms of precipitation?

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1. Explain the different ways of energy transfer in Earth’s atmosphere.

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1. What is the greenhouse effect and how does it relate to global warming?

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1. Explain lightning.

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1. How does a tornado form?

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1. Where does a hurricane receive its energy from?

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1. Describe some safety tips during periods of severe weather.

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**CONCLUSION (5 pts.) –** *Write a solid paragraph (at least 5 sentences) about your conclusions from the lab. Discuss the steps you went through during your lab experiment, what you accomplished, and how you tested your hypothesis. Also include what you learned as a result of this lab experiment.*

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